INTRODUCTION

Bouncing up and down on my father's bare holders, trying to keep still enough to see the bassist to the right. I could feel each vibration absorb into my six-year-old self. The song ends and the crowd screams. My dad lifts me off his shoulders. His white smile gleaming from behind the smoke, and concert lights. He takes off the construction ear protection that was too big for my face and asks if I'm alright. I just can't stop smiling. He laughs loud and puts the headphones back on me. We walk to the yellow tarp that stands out among the thousands of other blue ones strewn about town park. He sits me down and opens a bottle of water. He passes it, and takes it way as I reach… We laugh, then I chug. The crowd is leaving. I see my dad look around. I know that it's time to go, but with half open eyes I still wish I could stay for one more late night bluegrass song. We pack up and put our hats on. I refuse to put my jacket on, so my dad tucks me into his sweater. It covers my whole body and makes me feel important. We walk to the truck. My dad lifts me into the passenger seat. As he turns on the engine, the festival vibrations fade. I watch as my dad's hands turn the wheel side to side.

Two years later. I'm eight, and clicking my nails on the piano keys. My teacher, an older German woman, tells me to cut my nails so that they won't click why I play. She places a Shamrock green stool under my dangling feet. I pick treats from a tin and she places them on the keys. As I do my scales I get to eat the treats. Her treats are the ones I cant have at home, like Goldfish, pretzels, and sometimes chocolate covered German stuff too. About a year later I received an upright tiger wood piano.

Five years later I'm walking down a staircase in a mall in France and under the stairs is a music store. No other stores are around and it smells like a janitor's closet. Their is no one on this level of the mall. My shoes make echoing clicks as I walk towards the warm light reflecting off all the finished wooden instruments.

The store is packed with acoustic guitars. I look around. I see no one, I can't even see the back wall of the shop. Finally, a tall middle-aged man steps out from behind a row of wood and strings. He nods and asks if he can help. He mentions I can try any instrument I want, so I sheepishly walk around the shop with my hands in my pockets. I'm too scared to touch anything, but all I can think about is how cool it would be to hold that upright bass in my hands and pluck the thickest string. My friend walks in, out of breath, and her gaze softens as she finds me. She smiles and asks why I left the ice-cream shop. I don't want to tell her I was bored, so tell her I want to buy a guitar. I hadn't really thought of it before that moment, but what better time. I knew some basic chords and I knew how to teach myself. I bought the blond acoustic guitar with no name resting in the corner.

A few weeks later, some good calluses started to form on the tips of my fingers. And I found out I could sing. Another year later I formed a real band and got a ukulele.

Music has always been a big part of my life. It saved me in 1st grade, and again in my middle school rock band, and again on a year alone in France. What is music? Why does it make me feel? How does it make me feel?

In scientific terms it is a combination of chemical releases in the brain, most commonly 'dopamine' and other chemicals that trigger sensations in the rest of your body. Many things can trigger the release of dopamine, such as, physical contact, or any form of pleasure, drugs, alcohol etc… this includes music.

Music is a core function in our brain. There must be a reason our brains are able to process and comprehend music. Music has always been sort of a mystery, especially since it's not

typically considered necessary for survival (shelter/heat, food, sleep, and sex). The following five chapters will explore why and how we listen to and play music.

CHAPTER ONE

Science and curiosity has revealed so much — Space and time, DNA, origins of the universe — but one of the largest mysteries is right inside of our heads. The very thing we use to contemplate such mysteries, the brain. What makes us think, feel, love, desire, hope, and create. Why do we listen and play music? Why are some sounds music and others just noise?

Any time humans come together, there is music: birthdays, weddings, funerals, carnivals, graduation, or just parties. It doesn't come as a surprise that the music industry is one of the largest in the United States, employing hundreds of thousands of people. Americans in 2013 spent $2.4 billion on CDs and vinyl records, according to the Recording Industry Association of America Music Industry Shipment and Revenue Statistics. That's only CDs and vinyls, that doesn't even account for concert ticket sales, the thousands of bands playing Friday nights or the billion more songs that are being downloaded for free. Americans spend more money on music than on sex, porn, or prescription drugs.

Before TV and entertainment technology, families would entertain with music and conversation. Nowadays there is so much emphasis on technique, skill, and whether a musician is "good enough" to play for others. Music making has become a somewhat reserved skill in our culture, and the rest of us just listen. You might not call yourself a musician, but that shouldn't discourage you from making music. That raises some questions. Is all sound music? What separates noise and music?

In my opinion, it is the technical stuff. The organization of multiple vibrations that just fit together. To understand this, we might want to take some time to understand a bit about the technical terms that accompany music, and neuroscience.

CHAPTER TWO

What is music? I'm not asking what is good music. Before we talk about that we should probably understand a bit about how music affects our brains, our minds, our thoughts, and our spirit. This is where the technical music terms come out.

First, it is helpful to examine what music is made of. What are the fundamental building blocks of music? The basic elements of any sound are loudness, pitch, contour, duration (or rhythm), tempo, timbre, spatial location, and reverberation. And then there is meter, harmony, and melody. When we listen to music, we are actually perceiving multiple attributes or "dimensions."

What is a sound wave? A sound wave is produced by a mechanical vibration, like a tuning fork or a string. The vibrating object causes the surrounding air to vibrate as well. The wave travels through the air to your ear, and is heard. Just like any type of wave, a sound wave is also described by it's wavelength, amplitude, period, and frequency.

Wavelength is the distance from one point on the wave,
to the next identical point, or the length of one part of the wave.

Amplitude is the distance from the midpoint to the place of maximum displacement.

Frequency is the number of cycles that occur in one second.
Also the inverse of the period.

Period is the time it takes for a wave to complete one full cycle.

It is also the inverse of frequency.
Now in musical terms…

A discrete musical sound is usually called a tone. The word note is also used, but scientists reserve that word to refer to something that is notated on a page or score of music. The two terms, tone and note, refer to the same entity in the abstract, where the word tone refers to what you hear, and the word note refers to what you see written on a musical score.

Pitch is a purely psychological construct, related both to the actual frequency of a particular tone and to its relative position in the musical scale. It provides the answer to the question "What note is that?" ("It's a C-sharp.")

Rhythm refers to the durations of a series of notes, and to the way that they group together into units. For example, in the "Alphabet Song" (the same as "Twinkle, Twinkle Little Star") the notes of the song are all equal in duration for the letters A B C D E F G H I J K (with an equal duration pause, or rest, between G and H), and then the following four letters are sung with half the duration, or twice as fast per letter: L M N O (leading me, and many of my classmates to believing that there was a letter in the English alphabet called ellemmenno).

Tempo refers to the overall speed or pace of the piece.

Contour describes the overall shape of a melody, taking into account only the pattern of "up" and "down" (whether a note goes up or down, not the amount by which it goes up or down).

Timbre is that which distinguishes one instrument from another— say, trumpet from piano—when both are playing the same written note. It is a kind of tonal color that is produced in part by over- tones from the instrument's vibrations.

Loudness is a purely psychological construct that relates to the physical amplitude of a tone.

Spatial location is where the sound is coming from.

Reverberation refers to the perception of how distant the source is from us in combination with how large a room or hall the music is in; often referred to as "echo" by laypeople, it is the quality that distinguishes the spaciousness of singing in a large concert hall from the sound of singing in your shower. It has an under appreciated role in communicating emotion and creating an overall pleasing sound.

These attributes are separable. Each can be varied without altering the others, allowing the scientific study of one at a time, which is why we can think of them as dimensions. The difference between music and a random or disordered set of sounds has to do with the way these fundamental attributes combine, and the relations that form between them. When these basic elements combine and form relationships with one another in a meaningful way, they give rise to higher order concepts such as meter, key, melody, and harmony.

Meter is created by our brains by extracting information from rhythm and loudness cues, and refers to the way in which tones are grouped with one another across time. A waltz meter organizes tones into groups of three, a march into groups of two or four.

Key has to do with a hierarchy of importance that exists between tones in a musical piece; this hierarchy does not exist in-the-world, it exists only in our minds, as a function of our experiences with a musical style and musical idioms, and mental schemas that all of us develop for understanding music.

Harmony has to do with relationships between the pitches of different tones, and with tonal contexts that these pitches set up that ultimately lead to expectations for what will come next in a musical piece—expectations that a skillful composer can either meet or violate for

artistic and expressive purposes. Harmony can mean simply a parallel melody to the primary one (as when two singers harmonize) or it can refer to a chord progression—the clusters of notes that form a context and background on which the melody rests.

Melody is the main theme of a musical piece, the part you sing along with, the succession of tones that are most salient in your mind. The notion of melody is different across genres. In rock music, there is typically a melody for the verses and a melody for the chorus, and the verses are distinguished by a change in lyrics and sometimes by a change in instrumentation. In classical music, and jazz, the melody is a starting point for the composer to create variations on that theme, which may be used throughout the entire piece in different forms.

CHAPTER THREE

Now we can talk about that pink ball of flesh that can be held in the palm of ones hand. If we stop to think about how music came about, we can see that music is a very common, recurring activity. We find music and instruments around the world in all cultures. This means that music is something that is genetically engrained in us. So why is music genetic? Why do we have it? Many of us hear sounds and automatically describe it by saying what caused the sound. One might say, “I hear a car”, we can all hear the sound a car make sin our head, but we don't describe how it sound, we just describe it through the source of the sound. This is called Causal Listening. This is useful to identify the cause of a noise so that one can get out of harms way or to find such cause. This is a form of survival. We don't usually listen to sound just for the sake of it, but we do listen to music for the sake of it. We tend to listen to music as syntax — Not individual notes, but rather the relationship between the notes. This is something we do instinctively. We can find the pattern and math between music and that is what differentiates music from sound. As Edgard Varèse said, “Music is organized sound”.

Music is instinctual it is something we have developed as a genetic trait of survival and living. we play music together to show our compatibility, and ability to work as a group. As humans it its easy to see ourselves as individuals. unlike bees we are not one cohesive group. throughout history we have used music as a form of togetherness.

So how is it that we can move from a primitive form of making sound together to having such things as variation, learning, invention all the way to harmony, melody, and rhythm?

By studying animals we can observe their uses of vocalization in territory marking, and we can see their different uses of sound; Humans are very similar to many animals in how we use our voice. We know that primates use vocalization to communicate. We also know that they use such vocalizations to not only establish territory but also to identify. Different groups of primates will develop different variations of a common call to identify themselves.

Why would we evolve, to not only be able to synchronize rhythmically (which we don't see often in nature), but also to find rhythm so beautiful? Why would we spend so much time learning and developing interesting rhythms? How did we develop from rhythm to harmony and pitch?

While rhythm is more of a cultural phenomenon, harmony and pitch are a physical phenomenon. Multiple vibrations going on at the same time, in an organized way… This is all music, it is also a whole bunch of numbers and math.

In visual art there is a certain aesthetic pleasure that comes with symmetry, this is also an instinctual thing. In the natural world, things that are symmetrical are usually living organisms. This is a survival thing too. We are trained to notice and be aware of symmetry (to identify other living organisms). We are, for the same reason, drawn to music’s organization. In the same way

that we have this instinctual appreciation for symmetry we have the same instinctual gratitude in hearing things like an ‘octave’ or a ‘fifth’. Along with symmetry, another popular form of beauty is synchronization. In every culture, music is not alone, dance is very prominent as well. It seems that the more synchronized dance and music are, the more they are perceived as “better quality.”

Music and emotions are directly connected. Obviously music can evoke emotions and at many times a memory trigger. Music can control emotions, film directors can literally tell us how to feel by using the combination of music and environment. But it is very hard to do this specifically outside of film. Vary rarely does the audience ever really understand what the artist is trying to say exactly. Many times two people can be listening to the same piece, for example, a piano piece with no lyrics, one might think it was a sad song about loss when the other might think it was just a beautiful piece, not necessarily sad.

CHAPTER FOUR

For cognitive scientists, the word *mind* refers to that part of each of us that embodies our thoughts, hopes, desires, memories, beliefs, and experiences. The brain, on the other hand, is an organ of the body, a collection of cells and water, chemicals and blood vessels, that resides in the skull. Activity in the brain gives rise to the contents of the mind.

The total of our thoughts, beliefs, and experiences are represented in patterns of firings—electrochemical activity—in the brain. If the brain ceases to function, the mind is gone, but the brain can still exist, thoughtless, in a jar in someone’s laboratory.

The brain has regional differentiation of structure and function, but complex personality attributes are no doubt distributed widely throughout the brain.

The human brain is divided up into four lobes—the frontal, temporal, parietal, and occipital—plus the cerebellum. We can make some generalizations about function, but in fact, behavior is complex and can’t be mapped out simply. The frontal lobe is associated with planning, self-control, and making sense out of the dense and jumbled signals that our senses receive—the so-called “perceptual organization.” The temporal lobe is associated with hearing and memory. The parietal lobe is associated with motor movements and spatial skill, and the occipital lobe with vision. The cerebellum is involved in emotions and the planning of movements, and is the evolutionarily oldest part of our brain; even many animals, such as reptiles, that lack the “higher” brain region of the cortex still have a cerebellum.

Musical activity involves nearly every region of the brain that we know about, and nearly every neural subsystem. Different aspects of the music are handled by different neural regions. Listening to music starts with subcortical (below-the-cortex) structures—the cochlear nuclei, the brain stem, the cerebellum—and then moves up to auditory cortices on both sides of the brain. Tapping along with music, either actually or just in your mind, involves the cerebellum’s timing circuits. Performing music—regardless of what instrument you play, or whether you sing, or conduct—involves the frontal lobes again for the planning of your behavior, the motor cortex in the parietal lobe just underneath the top of your head, and the sensory cortex, which provides the tactile feedback that you have pressed the right key on your instrument, or moved the baton where you thought you did. Reading music involves the visual cortex, in the back of your head in the occipital lobe.

Because our brains split up tasks, there is a sizable difference between listening to music and performing the music. There is also a difference between listening to music out loud and listening to it in headphones. When we listen to music we are breaking it apart to understand it, then putting it back together to enjoy it. When we play or perform, not only are we listening, we are also using motor skills and muscle memory to play and control behavior, and using the visual reading and writing parts of our brain.

CHAPTER FIVE

Animals have this amazing ability… its called empathy. In our brains we contain what are called mirror neurons. These neurons fire when an action is made and when an action is observed. This is how we learn. This is also how we are able to icier the full experience of music. We are able to observe an action, our brain perceives it in the others perspective, than we can translate it, and be able to preform the same action. This explains our ability to empathize, to feel others pain, happiness, or sadness. If I where to watch someone being touched I would understand how that felt. The only reason I am not actually feeling it is because my skin feels. Our sensory receptors are telling our brain that we are not being touched so that you don't get confused. What would happen if the sensory receptors on that part of your body where gone? If a local anesthetic is induced than your brain can see and therefor *feel* the touch. this is just because we don't have pain and touch receptors confirming the sensation. This is another difference that occurs in our brains when performing rather than just listening. When we watch someone perform we are not using the full musical potential.

The only thing, in my opinion, separating us from each other is our skin. If we resolve that barrier than we have nothing to stop us from feeling exactly what we are seeing.

Now re-imagine what your brain does when it listens to music, when it pushes down on old strings on a mahogany neck, when it translates visual notes - to physical motions - to listening - and then creating new all over again.

CONCLUSION

Music is universal. The cultures and placement of people's may differ, but we are all human. Music is proof that we are no different in what we are, just different in what we think.

Music affects so much of your brain. Not only does it demand so much, but it also allows for empathy, awareness, and mind alterations that evoke emotions.

One of the most noble forms of knowledge is realizing that we know nothing.
when we think about it. We know very little about the very ball of flesh that we use to contemplate our own existence.

Thus, my conclusion is that, if music can't express a specific emotion, but an emotion non the less. What it is really doing is altering a state of awareness. For me, music alters time and space. As your perception of such exterior things changes, so does your perception of your interior state of mind. Consequently evoking emotions you have felt in similar states of being.

By observing our brains as it reacts to something specific such as music we can begin to understand the vast potential of our brains.
Our own brains are the biggest mystery. We actually really know nothing about ourselves.

Music is like a really really really good drug.
TAKE IT

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